

AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions and listings of claims in the application:

1. (Currently Amended) An image information encoding apparatus ~~adapted for blocking an input image signal to implement for performing~~ orthogonal transform transformation of an input image signal ~~thereto on the a block basis to perform for~~ quantization, the image information encoding apparatus comprising:

intra-image prediction means for adaptively changing block size ~~on the basis of used for prediction based on~~ a chroma format signal indicating resolution of a color signal and a color space signal indicating color space ~~to generate for generating a prediction image in performing intra-image predictive encoding of the color signal for the~~ input image signal;

~~transform~~ transformation means for performing, on a predetermined block size basis, integral ~~transform~~ transformation of a difference signal between the prediction image generated by the intra-image prediction means and an original image, and for generating transform coefficients;

quantization means for adaptively changing quantization technique in accordance with ~~transform~~ transformation processing by the ~~transform~~ transformation means to quantize the transform coefficients ~~generated by the transform means~~; and

encoding means for encoding the quantized transform coefficients ~~quantized by the quantization means~~, the chroma format signal, and the color space signal[[.]] ;

wherein the chroma format signal at least includes 4:2:0 format, 4:2:2 format, and 4:4:4 format, and the color space signal at least includes YCbCr, RGB, and XYZ, and
when the chroma format signal is 4:2:0 format and the color space signal is YCbCr, the intra-image prediction means adaptively changes the block size and generates the prediction image on an 8 × 8 pixel basis,
when the chroma format signal is 4:2:2 format and the color space signal is YCbCr, the intra-image prediction means adaptively changes the block size and generates the prediction image on an 8 × 16 pixel basis in which blocks of 8 × 8 pixels are arranged in a longitudinal direction, and
when the chroma format signal is 4:4:4 format and the color space signal is YCbCr, RGB, or XYZ, the intra-image prediction means adaptively changes the block size and generates the prediction image on a 16 × 16 pixel basis in which blocks of 8 × 8 pixels are arranged in longitudinal and lateral directions.

2. (Currently Amended) The image information encoding apparatus as set forth in claim 1, wherein the ~~transform~~ transformation means further performs integral ~~transform~~ transformation of blocks constituted by collecting only DC components after ~~undergone~~ undergoing integral transform on the predetermined block size ~~basis~~.

3-6. (Canceled)

7. (Currently Amended) The image information encoding apparatus as set forth in claim ~~[[4]]~~ 1, wherein ~~in the case where~~ when the chroma format signal is 4:2:0

format[[],] and the color space signal is YCbCr, the ~~transform~~ transformation means performs integral ~~transform~~ transformation of the difference signal on a 4 × 4 pixel basis to further perform integral ~~transform~~ transformation of blocks of 2 × 2 pixel units constituted by collecting transformed DC components.

8. (Currently Amended) The image information encoding apparatus as set forth in claim [[7]] 1, wherein when respective coefficients of the blocks of 2 × 2 pixel units are expressed as $\text{fdc}_{2 \times 2}$, respective coefficients $\text{fdc}'_{2 \times 2}$ after ~~undergone~~ undergoing integral ~~transform~~ transformation of the corresponding blocks₁ are represented by the following formula[[]] :

{4}

$$\begin{aligned} \text{fdc}'_{2 \times 2} &= T_2 \times \text{fdc}_{2 \times 2} \times T_2^T \\ &= \frac{1}{2} \begin{pmatrix} 1 & 1 \\ 1 & -1 \end{pmatrix} \text{fdc}_{2 \times 2} \begin{pmatrix} 1 & 1 \\ 1 & -1 \end{pmatrix} \end{aligned}$$

where

$$T_2 = \frac{1}{\sqrt{2}} \begin{pmatrix} 1 & 1 \\ 1 & -1 \end{pmatrix}.$$

9. (Currently Amended) The image information encoding apparatus as set forth in claim [[5]] 1, wherein ~~in the case where~~ when the chroma format signal is 4:2:2 format[[],] and the color space signal is YCbCr, the ~~transform~~ transformation means performs integral ~~transform~~ transformation of the difference signal on a 4 × 4 pixel basis to further perform integral ~~transform~~ transformation of blocks of 2 × 4 pixel units constituted by collecting transformed DC components.

10. (Currently Amended) The image information encoding apparatus as set forth in claim 9, wherein when respective coefficients of the blocks of 2×4 pixel units are expressed as $\text{fdc}_{2 \times 4}$, respective coefficients $\text{fdc}'_{2 \times 4}$ after ~~undergone~~ undergoing integral ~~transform~~ transformation of the corresponding blocks, are represented by the following formula[.]:

[2]

$$\begin{aligned} \text{fdc}'_{2 \times 4} &= T_{v(4)} \times \text{fdc}_{2 \times 4} \times T_{h(2)}^T \\ &= \frac{1}{2\sqrt{2}} \begin{pmatrix} 1 & 1 & 1 & 1 \\ 1 & 1 & -1 & -1 \\ 1 & -1 & -1 & 1 \\ 1 & -1 & 1 & -1 \end{pmatrix} \text{fdc}_{2 \times 4} \begin{pmatrix} 1 & 1 \\ 1 & -1 \end{pmatrix} \end{aligned}$$

where

$$T_{v(4)} = \begin{pmatrix} 1 & 1 & 1 & 1 \\ 1 & 1 & -1 & -1 \\ 1 & -1 & -1 & 1 \\ 1 & -1 & 1 & -1 \end{pmatrix}$$

$$T_{h(2)} = \begin{pmatrix} 1 & 1 \\ 1 & -1 \end{pmatrix}$$

11. (Currently Amended) The image information encoding apparatus as set forth in claim 10, wherein the relationship between the $\text{fdc}_{2 \times 4}$ and the $\text{fdc}'_{2 \times 4}$ is approximated by the following formula[.]:

[3]

$$\begin{aligned}
 \text{fdc}'_{2 \times 4} &= T_{v(4)} \times \text{fdc}_{2 \times 4} \times T_{h(2)}^T \\
 &= \frac{1}{2\sqrt{2}} \begin{pmatrix} 1 & 1 & 1 & 1 \\ 1 & 1 & -1 & -1 \\ 1 & -1 & -1 & 1 \\ 1 & -1 & 1 & -1 \end{pmatrix} \text{fdc}_{2 \times 4} \begin{pmatrix} 1 & 1 \\ 1 & -1 \end{pmatrix} \\
 &\approx \frac{1}{4} \begin{pmatrix} 1 & 1 & 1 & 1 \\ 1 & 1 & -1 & -1 \\ 1 & -1 & -1 & 1 \\ 1 & -1 & 1 & -1 \end{pmatrix} \text{fdc}_{2 \times 4} \begin{pmatrix} 1 & 1 \\ 1 & -1 \end{pmatrix}
 \end{aligned}$$

12. (Currently Amended) The image information encoding apparatus as set forth in claim [[6]] 1, wherein in the case where the chroma format signal is 4:4:4 format[[,]] and the color space signal is YCbCr, RGB₁ or XYZ, the ~~transform~~ transformation means performs integral ~~transform~~ transformation of the difference signal on a 4 × 4 pixel basis to further perform integral ~~transform~~ transformation of blocks of 4 × 4 pixel units constituted by collecting transformed DC components.

13. (Currently Amended) The image information encoding apparatus as set forth in claim 12, wherein when respective coefficients of the blocks of 4 × 4 pixel units are expressed as fdc_{4 × 4}, respective coefficients fdc'_{4 × 4} after ~~undergone~~ undergoing integral ~~transform~~ transformation of the corresponding blocks₁ are represented by the following formula[[.]] :

{4}

$$\begin{aligned} \text{fdc}'_{4 \times 4} &= T_4 \times \text{fdc}_{4 \times 4} \times T_4^T \\ &= \frac{1}{4} \begin{pmatrix} 1 & 1 & 1 & 1 \\ 1 & 1 & -1 & -1 \\ 1 & -1 & -1 & 1 \\ 1 & -1 & 1 & -1 \end{pmatrix} \text{fdc}_{4 \times 4} \begin{pmatrix} 1 & 1 & 1 & 1 \\ 1 & 1 & -1 & -1 \\ 1 & -1 & -1 & 1 \\ 1 & -1 & 1 & -1 \end{pmatrix} \end{aligned}$$

where

$$T_4 = \frac{1}{2} \begin{pmatrix} 1 & 1 & 1 & 1 \\ 1 & 1 & -1 & -1 \\ 1 & -1 & -1 & 1 \\ 1 & -1 & 1 & -1 \end{pmatrix}.$$

14. (Currently Amended) An image information encoding method of ~~blocking an input image signal to implement~~ for performing orthogonal transform transformation ~~thereto on the a block basis to perform~~ for quantization, the image information encoding method including:

~~an intra-image prediction step of adaptively changing block size on the basis of~~ used for prediction based on a chroma format signal indicating resolution of a color signal and a color space signal indicating color space to generate a prediction image in ~~performing intra-image predictive encoding of the color signal~~ of an input image signal;

~~a transform step of performing, on a predetermined block size basis, integral transform~~ transformation processing of a difference signal between the prediction image ~~generated at the intra-image prediction step~~ and an original image;

generating transform coefficients;

~~a quantization step~~ of adaptively changing a quantization technique in accordance with ~~transform~~ the transformation processing ~~at the transform step~~ to quantize the transform coefficients ~~generated at the transform step~~; and

~~an encoding step~~ of encoding the quantized transform coefficients ~~quantized at the quantization step~~, the chroma format signal, and the color space signal[[.]] ;

wherein the chroma format signal at least includes 4:2:0 format, 4:2:2 format, and 4:4:4 format, and the color space signal at least includes YCbCr, RGB, and XYZ, and

when the chroma format signal is 4:2:0 format and the color space signal is YCbCr, the block size is adaptively changed and the prediction image is generated on an 8 × 8 pixel basis,

when the chroma format signal is 4:2:2 format and the color space signal is YCbCr, the block size is adaptively changed and the prediction image is generated on an 8 × 16 pixel basis in which blocks of 8 × 8 pixels are arranged in a longitudinal direction, and

when the chroma format signal is 4:4:4 format and the color space signal is YCbCr, RGB, or XYZ, the block size is adaptively changed and the prediction image is generated on a 16 × 16 pixel basis in which blocks of 8 × 8 pixels are arranged in longitudinal and lateral directions.

15. (Currently Amended) The image information encoding method as set forth in claim 14, further comprising:

~~wherein, at the transform step,~~ integral transform transforming of blocks
constituted by collecting only DC components after ~~undergone~~ undergoing integral
~~transform~~ transformation on the predetermined block size basis ~~is further performed.~~

16-25. (Canceled)